

0092569-101101

1. An aggregate comprising a carbon phase and a silicon-containing species phase, wherein said aggregate is characterized by at least one of the following characteristics:
  - a) a difference between BET ( $N_2$ ) surface area and t-area of from about 2 to about 100  $m^2/g$ ;
  - b) a difference between BET ( $N_2$ ) surface area and t-area of from about 1 to about 50  $m^2/g$  after HF treatment;
  - c) a ratio of from about 0.1 to about 10 based on 1) the difference in BET ( $N_2$ ) surface area between the aggregate after and before HF treatment to 2) weight percentages of silicon content in said aggregate without HF treatment;
  - d) a weight average aggregate size measured by DCP after HF treatment is reduced by about 5% to about 40% compared to weight average aggregate size without HF treatment;
  - e) a silica ash content in said aggregate of from about 0.05% to about 1% based on the weight of said aggregate after HF treatment and based on ash resulting from silicon-containing compound; and
  - f) A BET surface area of silica ash in said aggregate of from about 200  $m^2/g$  to about 700  $m^2/g$ .
2. The aggregate of claim 1, wherein said aggregate is characterized by at least two of the characteristics.
3. The aggregate of claim 1, wherein the aggregate is characterized by at least three of the characteristics.
4. The aggregate of claim 1, wherein the aggregate is characterized by at least four of the characteristics.
5. The aggregate of claim 1, wherein the aggregate is characterized by a) and b).
6. The aggregate of claim 1, wherein the aggregate is characterized by a) and c).

7. The aggregate of claim 1, wherein the aggregate is characterized by a).
8. The aggregate of claim 1, wherein the aggregate is characterized by b).
9. The aggregate of claim 1, wherein the aggregate is characterized by c).
10. The aggregate of claim 1, wherein the aggregate is characterized by d).
11. The aggregate of claim 1, wherein the aggregate is characterized by e).
12. The aggregate of claim 1, wherein the aggregate is characterized by a) and has a BET surface area of silica ash is said aggregate of from about 200 m<sup>2</sup>/g to about 700 m<sup>2</sup>/g.
13. The aggregate of claim 1, wherein the aggregate has a t-area above about 100 m<sup>2</sup>/g and the difference between BET (N<sub>2</sub>) and t-area is from about 10 to about 50 m<sup>2</sup>/g.
14. The aggregate of claim 1, wherein when the aggregate is HF treated, the aggregate has a difference between BET (N<sub>2</sub>) surface area and t-area of from about 5 to about 40 m<sup>2</sup>/g.
15. The aggregate of claim 1, wherein the ratio for c) is from about 0.1 to about 5.
16. The aggregate of claim 1, wherein the BET surface area of silica ash in said aggregate is from about 200 m<sup>2</sup>/g to about 700 m<sup>2</sup>/g.
17. The aggregate of claim 1, wherein said aggregate has an elemental silicon content of from about 0.1 to about 25 wt%, based on the weight of the aggregate.
18. The aggregate of claim 1, wherein said aggregate has an elemental silicon content

of from about 4 to about 10 wt%, based on the weight of the aggregate.

19. The aggregate of claim 1, wherein said aggregate has an elemental silicon content of from about 8 to about 15 wt%, based on the weight of the aggregate.

20. The aggregate of claim 1, wherein when said aggregate is incorporated into an elastomeric composition, the wet skid resistance of the elastomeric composition is improved compared to the same elastomeric composition having carbon black.

21. The aggregate of claim 1, wherein said aggregate imparts to an elastomer poorer abrasion resistance, comparable or higher loss tangent at low temperature and a lower loss tangent at high temperature, compared to carbon black.

22. The aggregate of claim 1, wherein when said aggregate is incorporated into an elastomeric composition, the rolling resistance of the elastomeric composition is improved compared to the same elastomeric composition having carbon black.

23. An elastomeric composition comprising at least one elastomer and the aggregate of claim 1, and optionally a coupling agent.

24. The elastomeric composition of claim 23, wherein said elastomer comprises natural rubber, polyisoprene, polybutadiene, emulsion SBR, solution SBR, functionalized SBR, NBR, butyl rubber, EPDM, EPM, or homo- or co-polymers based on or containing 1,3 butadiene, styrene, isoprene, isobutylene, 2,3-dimethyl-1,3-butadiene, acrylonitrile, ethylene, propylene, or derivatives thereof.

25. The elastomeric composition of claim 23, further comprising a curing agent, reinforcing filler, a coupling agent, processing aids, oil extenders, antidegradents, or combinations thereof.

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26. The elastomeric composition of claim 23, further comprising silica, carbon black or mixtures thereof.

27. The elastomeric composition of claim 23, further comprising silica, carbon black, modified carbon black having an attached organic group, modified silica, carbon black at least partially coated with silica, or combinations thereof.

28. The elastomeric composition of claim 23, wherein the aggregate has attached at least one organic group.

29. The elastomeric composition of claim 23, further comprising an aggregate comprising a carbon phase and a silicon-containing species phase, and having attached at least one organic group.

30. The aggregate of claim 23, wherein the aggregate has attached at least one organic group.

31. The elastomeric composition of claim 23, wherein said elastomeric composition has low hysteresis at high temperature, wherein said high temperature is from 20 to 100°C.

32. The elastomeric composition of claim 23, wherein said elastomeric composition has a low rolling resistance when used in tire compounds.

33. The elastomeric composition of claim 23, wherein said elastomeric composition has an increase in wet skid resistance compared to the same elastomeric composition containing carbon black.

34. The elastomeric composition of claim 23, wherein said elastomeric composition has an increase in wet skid resistance of greater than 3% compared to the same elastomeric composition containing carbon black.





wherein said reactor has a sufficient temperature to decompose said silicon-containing compound and to form carbon black from the carbon black-yielding feedstock and wherein at least one of said first and second feedstocks includes a diluent.

48. The method of claim 47, wherein said diluent is present in said at least one feedstock in an amount effective to increase the mass flow rate of the feedstock, lower the temperature of the reactor at about the point of introduction of the feedstock, or both.

49. The method of claim 47, wherein said diluent is present in said silicon-containing compound feedstock.

50. The method of claim 47, wherein said diluent comprises at least one alcohol, water, aqueous based solution, or mixtures thereof.

51. The method of claim 47, wherein said diluent is introduced to said reactor separately from said first and second feedstocks.

52. The method of claim 47, wherein said diluent is at least one of said first and second feedstocks.

53. The method of claim 47, wherein said diluent comprises an alcohol or a mixture of alcohols.

54. The method of claim 47, wherein said diluent is water.

55. The method of claim 47, wherein said silicon-containing compound feedstock and said diluent both comprise an alcohol or a mixture of alcohols.

56. The method of claim 47, wherein said diluent is a gas.

57. The method of claim 47, wherein said diluent is miscible with said silicon-containing compound.

58. The method of claim 47, wherein said diluent is volatilizable, decomposable, or both.

59. An aggregate comprising a carbon phase and a silicon-containing species phase, wherein said aggregate is characterized by at least one of the following characteristics:

a) a difference between BET ( $N_2$ ) surface area and t-area of from about 2 to about  $100 \text{ m}^2/\text{g}$ ;

b) a difference between BET ( $N_2$ ) surface area and t-area of from about 1 to about  $50 \text{ m}^2/\text{g}$  after HF treatment;

c) a ratio of from about 0.1 to about 10 based on 1) the difference in BET ( $N_2$ ) surface area between the aggregate after and before HF treatment to 2) weight percentages of silicon content in said aggregate without HF treatment.

d) a weight average aggregate size measured by DCP after HF treatment is reduced by about 5% to about 40% compared to weight average aggregate size without HF treatment;

e) a silica ash content in said aggregate of from about 0.05% to about 1% based on the weight of said aggregate after HF treatment and based on ash resulting from silicon-containing compound; and

f) A BET surface area of silica ash in said aggregate of from about  $200 \text{ m}^2/\text{g}$  to about  $700 \text{ m}^2/\text{g}$ , wherein the silicon-containing species phase is present primarily at the surface of the aggregate.

60. The aggregate of claim 59, wherein said silicon-containing species phase has a visible surface area of from  $64.8 \text{ m}^2/\text{g}$  to  $105.3 \text{ m}^2/\text{g}$ .

61. The aggregate of claim 59, wherein said aggregate is characterized by at least two of the characteristics.

62. The aggregate of claim 59, wherein the aggregate is characterized by at least three of the characteristics.

63. The aggregate of claim 59, wherein the aggregate is characterized by at least four of the characteristics.



64. The aggregate of claim 59, wherein the aggregate is characterized by a) and b).
65. The aggregate of claim 59, wherein the aggregate is characterized by a) and c).
66. The aggregate of claim 59, wherein the aggregate is characterized by a).
67. The aggregate of claim 59, wherein the aggregate is characterized by b).
68. The aggregate of claim 59, wherein the aggregate is characterized by c).
69. The aggregate of claim 59 wherein the aggregate is characterized by d).
70. The aggregate of claim 59, wherein the aggregate is characterized by e).
71. The aggregate of claim 59, wherein the aggregate is characterized by a) and has a BET surface area of silica ash is said aggregate of from about 200 m<sup>2</sup>/g to about 700 m<sup>2</sup>/g.
72. The aggregate of claim 59, wherein the aggregate has a t-area above about 100 m<sup>2</sup>/g and the difference between BET (N<sub>2</sub>) and t-area is from about 10 to about 50 m<sup>2</sup>/g.
73. The aggregate of claim 59, wherein when the aggregate is HF treated, the aggregate has a difference between BET (N<sub>2</sub>) and t-area of from about 5 to about 40 m<sup>2</sup>/g.
74. The aggregate of claim 59, wherein the ratio for c) is from about 0.1 to about 5.
75. The aggregate of claim 59, wherein the BET surface area of silica ash in said aggregate is from about 200 m<sup>2</sup>/g to about 700 m<sup>2</sup>/g.
76. The aggregate of claim 59, wherein said aggregate has an elemental silicon content of from about 0.1 to about 25 wt%, based on the weight of the aggregate.
77. The aggregate of claim 59, wherein said aggregate has an elemental silicon content of from about 4 to about 10 wt%, based on the weight of the aggregate.
78. The aggregate of claim 59, wherein said aggregate has an elemental silicon content of from about 8 to about 15 wt%, based on the weight of the aggregate.
79. The aggregate of claim 59, wherein when said aggregate is incorporated into an elastomeric composition, the wet skid resistance of the elastomeric composition is improved compared to the same elastomeric composition having carbon black.

80. The aggregate of claim 59, wherein said aggregate imparts to an elastomer poorer abrasion resistance, comparable or higher loss tangent at low temperature and a lower loss tangent at high temperature, compared to carbon black.

81. The aggregate of claim 59, wherein when said aggregate is incorporated into an elastomeric composition, the rolling resistance of the elastomeric composition is improved compared to the same elastomeric composition having carbon black.

82. An elastomeric composition comprising at least one elastomer and the aggregate of claim 59, and optionally a coupling agent.

83. The elastomeric composition of claim 82, wherein said elastomer comprises natural rubber, polyisoprene, polybutadiene, emulsion SBR, solution SBR, functionalized SBR, NBR, butyl rubber, EPDM, EPM, or homo- or co-polymers based on or containing 1,3 butadiene, styrene, isoprene, isobutylene, 2,3-dimethyl-1,3-butadiene, acrylonitrile, ethylene, propylene, or derivatives thereof.

84. The elastomeric composition of claim 82, further comprising a curing agent, reinforcing filler, a coupling agent, processing aids, oil extenders, antidegradents, or combinations thereof.

85. The elastomeric composition of claim 82, further comprising silica, carbon black or mixtures thereof.

86. The elastomeric composition of claim 82, further comprising silica, carbon black, modified carbon black having an attached organic group, modified silica, carbon black at least partially coated with silica, or combinations thereof.

87. The elastomeric composition of claim 82, wherein the aggregate has attached at least one organic group.

88. The elastomeric composition of claim 82, further comprising an aggregate comprising a carbon phase and a silicon-containing species phase, and having attached at least one organic group.

89. The aggregate of claim 82, wherein the aggregate has attached at least one organic group.

90. The elastomeric composition of claim 82, wherein said elastomeric composition has low hysteresis at high temperature, wherein said high temperature is from 20 to 100°C.

91. The elastomeric composition of claim 82, wherein said elastomeric composition has a low rolling resistance when used in tire compounds.

92. The elastomeric composition of claim 82, wherein said elastomeric composition has an increase in wet skid resistance compared to the same elastomeric composition containing carbon black.

93. The elastomeric composition of claim 82, wherein said elastomeric composition has an increase in wet skid resistance of greater than 3% compared to the same elastomeric composition containing carbon black.

94. The elastomeric composition of claim 82, wherein said elastomeric composition has an increase in wet skid resistance of from greater than 3% to about 20% compared to the same elastomeric composition containing carbon black.

95. An aggregate comprising a carbon phase and a silicon-containing species phase, wherein said aggregate is characterized by at least one of the following characteristics:

a) a difference between BET ( $N_2$ ) surface area and t-area of from about 2 to about 100  $m^2/g$ ;

b) a difference between BET ( $N_2$ ) surface area and t-area of from about 1 to about 50  $m^2/g$  after HF treatment;

c) a ratio of from about 0.1 to about 10 based on 1) the difference in BET ( $N_2$ ) surface area between the aggregate after and before HF treatment to 2) weight percentages of silicon content in said aggregate without HF treatment.

d) a weight average aggregate size measured by DCP after HF treatment is reduced by about 5% to about 40% compared to weight average aggregate size without HF treatment;

e) a silica ash content in said aggregate of from about 0.05% to about 1% based on the weight of said aggregate after HF treatment and based on ash resulting from silicon-containing compound; and

f) A BET surface area of silica ash in said aggregate of from about 200  $m^2/g$  to about 700  $m^2/g$ , wherein said aggregate has silanol groups located at the surface of the aggregate.

96. The aggregate of claim 95, wherein said silanol groups are present in an amount of 0.16 Mmol/g to 0.26 Mmol/g.

97. The aggregate of claim 95, wherein said aggregate is characterized by at least two of the characteristics.

98. The aggregate of claim 95, wherein the aggregate is characterized by at least three of the characteristics.

99. The aggregate of claim 95, wherein the aggregate is characterized by at least four of the characteristics.

100. The aggregate of claim 95, wherein the aggregate is characterized by a) and b).

101. The aggregate of claim 95, wherein the aggregate is characterized by a) and c).

102. The aggregate of claim 95, wherein the aggregate is characterized by a).

103. The aggregate of claim 95, wherein the aggregate is characterized by b).

104. The aggregate of claim 95, wherein the aggregate is characterized by c).

105. The aggregate of claim 95, wherein the aggregate is characterized by d).

106. The aggregate of claim 95, wherein the aggregate is characterized by e).

107. The aggregate of claim 95, wherein the aggregate is characterized by a) and has a BET surface area of silica ash is said aggregate of from about 200 m<sup>2</sup>/g to about 700 m<sup>2</sup>/g.

108. The aggregate of claim 95, wherein the aggregate has a t-area above about 100 m<sup>2</sup>/g and the difference between BET (N<sub>2</sub>) and t-area is from about 10 to about 50 m<sup>2</sup>/g.

109. The aggregate of claim 95, wherein when the aggregate is HF treated, the aggregate has a difference between BET (N<sub>2</sub>) and t-area of from about 5 to about 40 m<sup>2</sup>/g.

110. The aggregate of claim 95, wherein the ratio for c) is from about 0.1 to about 5.

111. The aggregate of claim 95, wherein the BET surface area of silica ash in said aggregate is from about 200 m<sup>2</sup>/g to about 700 m<sup>2</sup>/g.

112. The aggregate of claim 95, wherein said aggregate has an elemental silicon content of from about 0.1 to about 25 wt%, based on the weight of the aggregate.

113. The aggregate of claim 95, wherein said aggregate has an elemental silicon content of from about 4 to about 10 wt%, based on the weight of the aggregate.

114. The aggregate of claim 95, wherein said aggregate has an elemental silicon content of from about 8 to about 15 wt%, based on the weight of the aggregate.

115. The aggregate of claim 95, wherein when said aggregate is incorporated into an elastomeric composition, the wet skid resistance of the elastomeric composition is improved compared to the same elastomeric composition having carbon black.

116. The aggregate of claim 95, wherein said aggregate imparts to an elastomer poorer abrasion resistance, comparable or higher loss tangent at low temperature and a lower loss tangent at high temperature, compared to carbon black.

117. The aggregate of claim 95, wherein when said aggregate is incorporated into an elastomeric composition, the rolling resistance of the elastomeric composition is improved compared to the same elastomeric composition having carbon black.

118. An elastomeric composition comprising at least one elastomer and the aggregate of claim 95, and optionally a coupling agent.

119. The elastomeric composition of claim 118, wherein said elastomer comprises natural rubber, polyisoprene, polybutadiene, emulsion SBR, solution SBR, functionalized SBR, NBR, butyl rubber, EPDM, EPM, or homo- or co-polymers based on or containing 1,3 butadiene, styrene, isoprene, isobutylene, 2,3-dimethyl-1,3-butadiene, acrylonitrile, ethylene, propylene, or derivatives thereof.

120. The elastomeric composition of claim 118, further comprising a curing agent, reinforcing filler, a coupling agent, processing aids, oil extenders, antidegradents, or combinations thereof.

121. The elastomeric composition of claim 118, further comprising silica, carbon black or mixtures thereof.

122. The elastomeric composition of claim 118, further comprising silica, carbon black, modified carbon black having an attached organic group, modified silica, carbon black at least partially coated with silica, or combinations thereof.

123. The elastomeric composition of claim 118, wherein the aggregate has attached at least one organic group.

124. The elastomeric composition of claim 118, further comprising an aggregate comprising a carbon phase and a silicon-containing species phase, and having attached at least one organic group.

125. The aggregate of claim 118, wherein the aggregate has attached at least one organic group.

126. The elastomeric composition of claim 118, wherein said elastomeric composition has low hysteresis at high temperature, wherein said high temperature is from 20 to 100°C.

127. The elastomeric composition of claim 118, wherein said elastomeric composition has a low rolling resistance when used in tire compounds.

128. The elastomeric composition of claim 118, wherein said elastomeric composition has an increase in wet skid resistance compared to the same elastomeric composition containing carbon black.

129. The elastomeric composition of claim 118, wherein said elastomeric composition has an increase in wet skid resistance of greater than 3% compared to the same elastomeric composition containing carbon black.

130. The elastomeric composition of claim 118, wherein said elastomeric composition has an increase in wet skid resistance of from greater than 3% to about 20% compared to the same elastomeric composition containing carbon black.